

Laboratory technician: study guide

Science, laboratory, agriculture, food, and environment · suite apt-200-laboratory-technician · generated 2026-09-15T15:27:55.780Z

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Private practice result. Not an official exam certificate, employer decision, hiring signal, admissions decision, or guaranteed outcome. Scores stay on this device unless you export them.

Answer keys and scoring logic stay server-side and are never included in any download or export.

How to use this guide

This file contains the whole study outline for this suite: every skill it draws on, the full lesson for each of those skills, worked examples, practice tips, a glossary, and where each piece of material comes from. Nothing here is a summary of a page you still have to visit.

1. Read the skills section end to end once, without timing yourself.
2. Work the guided practice mode for the suite, using the practice tips as a checklist.
3. Move to the mini-test only when guided practice feels unhurried.
4. Sit the full simulation last, once, in the conditions you expect on the day.

Practice attempts are stored on the device you used, never on an account. Exporting a result is the only way anything leaves that device.

Practice modes and durations

Practice modes for Laboratory technician

Mode	Duration	What it is for
Guided practice	15 minutes	Untimed, with feedback after every item.
Mini-test	18 minutes	A short timed set for checking pace.
Full simulation	45 minutes	Full length and full time, in one sitting.

- Start guided practice:
<https://learn.novusstreamsolutions.com/aptitude/practice/new?bank=apt-200-laboratory-technician&mode=guided>
- Start mini-test:
<https://learn.novusstreamsolutions.com/aptitude/practice/new?bank=apt-200-laboratory-technician&mode=mini>
- Start full simulation:
<https://learn.novusstreamsolutions.com/aptitude/practice/new?bank=apt-200-laboratory-technician&mode=full>

Skills covered, in full

This suite draws on 5 skill constructs. Each one below carries its complete lesson.

Technical reasoning

Applied technical principles, diagrams, tools, systems, measurements, and troubleshooting.

Technical reasoning is what sits above any single trade: reading a system diagram for what it actually does, isolating a fault by measurement instead of by guesswork, and taking the governing number off a drawing or a nameplate without importing assumptions. It is assessed in HVAC, instrumentation, mechatronics, process-operator and engineering-technician selection, and it is the construct that best predicts whether someone can diagnose an unfamiliar machine. Employers care about it because part-swapping is expensive and half-splitting is not. Practice sessions here stay on your device unless you choose to export them.

What you should be able to do after this lesson:

1. Trace a process or signal diagram end to end and state, for a given symptom, which components could physically cause it and which could not.
2. Isolate a fault by half-splitting a chain of stages, and say how many measurements a chain of a given length should take.
3. Convert a dimension with asymmetric tolerance into an acceptance window and decide whether a measured part passes, can be reworked, or is scrap.
4. Match a measuring instrument to a required resolution, and distinguish an instrument's resolution from its accuracy.
5. Describe a closed control loop as sensor, controller, setpoint, actuator and feedback, then design the one measurement that separates a sensor fault from an actuator fault.
6. Read the qualifier attached to a rated number (duty cycle, working load limit, working pressure, nominal versus maximum), and apply it correctly.

Worked examples and pitfalls

Half-splitting beats swapping parts: A conveyor will not stop when its photo-eye is blocked. The chain is: sensor, field cable, junction box, PLC input card, PLC program, output card, interposing relay, contactor. Eight places the signal can die. Swapping parts one at a time means four or five attempts on average, since the culprit is equally likely to sit anywhere in the eight, and every attempt costs a part. Half-splitting starts in the middle instead: watch the PLC input LED while a colleague blocks the beam. If it toggles, the sensor, field cable, junction box and input card are all proven good in a single observation, and eight candidates become four. Force the output in the PLC and watch the contactor: if it pulls in, the output card, interposing relay and contactor are good as well, so the fault is in the program logic rather than the hardware. Three checks resolve eight stages, because each check halves the remaining suspects. The trap is starting at whichever end is easiest to reach, which resolves one stage per check instead of half of them. The second trap is the sentence 'I replaced the sensor and it still fails', that proves only that the sensor was not the fault, at the price of a part and an hour.

Tolerance: in spec, or scrap?: A drawing calls a shaft 25.00 mm with a tolerance of plus 0.05 and minus 0.10. That is an asymmetric tolerance, so the acceptance window runs from 24.90 mm to 25.05 mm and the nominal is not at its centre. A part measuring 24.92 mm is inside the window and passes, even though it is below nominal: the most common wrong rejection on this style of item, made by anyone who silently reads the tolerance as plus or minus 0.05. A part at 25.06 mm fails by 0.01 mm, but it fails oversize, so material can still be removed and it is rework rather than scrap. A part at 24.85 mm fails undersize and there is no recovering it. One more layer the better items include: if you took that 25.06 reading on a caliper with 0.02 mm resolution, the reading is at the very limit of what the instrument can resolve, and the honest next step is

to re-measure with a micrometer before anyone scraps or reworks anything.

Reading a system diagram: what can actually cause this?: A tank fill line is drawn as supply, isolation valve V1, strainer, pump P1, check valve, control valve CV1, tank. A high-level switch LSH-1 is wired to close CV1. The reported symptom is that the tank overfilled. Work the path between the measurement and the element that stops flow: a CV1 that has stuck open, an LSH-1 that never actuated, and a broken wire in the LSH-1 loop are all consistent with the symptom. A blocked strainer is not: restricting the inlet reduces flow, and no amount of restriction causes an overflow. Nor is the check valve, whose function is to prevent reverse flow, not forward flow. Candidates pick the strainer because it is the component they know fouls in service, which is a memory of maintenance history rather than a reading of the diagram. The discipline that earns the mark is directional: a component can only be responsible if it lies on the causal path AND its failure mode pushes the system in the direction of the symptom.

Instrument choice: resolution is not accuracy: A steel rule resolves to roughly 0.5 mm. A vernier caliper marked 0.02 mm resolves to 0.02 mm. A 0 to 25 mm micrometer resolves 0.01 mm on the thimble, or 0.001 mm if it carries a vernier. A dial indicator reads 0.01 mm of relative movement but tells you nothing about absolute size without a reference. Asked to verify a 25.00 mm shaft with a tolerance of plus or minus 0.02 mm, the tolerance band is 0.04 mm wide: two divisions on that caliper, which is not enough to judge anything reliably. The workshop convention is that the instrument should resolve to about a tenth of the tolerance band, here 0.004 mm, so even the micrometer is marginal and comparison against gauge blocks is the defensible answer. The trap the item is built around is a digital display: showing four decimal places is a statement about resolution, not accuracy. An uncalibrated digital caliper will report 25.0000 mm with total confidence and be 0.03 mm out.

Closed loop: which element failed?: A room is meant to hold 21 degrees Celsius. A thermostat containing the sensor and the controller drives a valve on a radiator. The symptom: the room reaches 28 degrees Celsius and the valve stays open. Three explanations survive first inspection. The sensor reads low so the controller still believes the room is cold, the valve is mechanically jammed open, or the controller output has failed in the on state. One measurement separates them. Put an independent thermometer beside the thermostat. If the thermostat displays 17 degrees while the thermometer reads 28, the sensor is lying and everything downstream is behaving correctly. If the thermostat displays 28 and is still calling for heat, the sensor is fine and the fault is in the controller or the valve, which you then split by checking whether the valve actuator is being energised. The tempting non-answer is 'the room is too hot, so lower the setpoint'. That treats the symptom, and if the sensor reads seven degrees low the loop will simply settle seven degrees high again at the new setpoint.

Nameplates: read the qualifier, not just the number: A welding machine is rated 200 A at 40 percent duty cycle over a ten-minute period. That means four minutes of arc time and six minutes of cooling in every ten, at the full 200 A. It does not mean 40 percent of 200 A, and it does not mean 40 percent of an hour. Both wrong readings feel entirely natural, which is why they make good distractors. Run the machine continuously at 200 A and the thermal cut-out will open. The same discipline transfers across the whole trade: a hoist's working load limit is not its breaking load, a hose's working pressure is not its burst pressure, a motor's service factor describes a short-term overload allowance and not a continuous rating, and a pump curve's flow figure is quoted at a stated head. Whenever an item hands you a number in a table or on a plate, underline the qualifier printed next to it before you calculate anything; the wrong options are usually built by dropping exactly one qualifier.

How to practise this skill

- Trace every diagram with a pencil from input to output and name each block as you pass it. Technical items punish skimming far harder than they punish slow arithmetic.
- Rehearse half-splitting on systems you already know (a home network that has dropped out, a car that will not crank), and count the checks. The habit transfers to the test intact.

- Underline the qualifier beside every number a question supplies: per hour, at 20 degrees Celsius, at 40 percent duty, nominal, maximum. That single mark-up defuses most distractors.
- Convert the whole question to one unit system in one pass before calculating, rather than converting each intermediate result and accumulating rounding.
- Train yourself to state what a measurement PROVES rather than what it reads. '12 V present at the coil' proves the supply and the whole upstream path; it says nothing about whether the coil itself is good.
- Keep a running list of the schematic symbols and component names you personally keep getting wrong, and drill only those. Five focused minutes beats another full untargeted set, and your attempt history stays local to this device so the list is yours alone.

Glossary

Half-split fault finding: Testing at the midpoint of a chain of stages so that each measurement eliminates half the remaining suspects. A chain of eight stages resolves in about three checks rather than four swaps.

Tolerance band: The distance between the upper and lower acceptance limits of a dimension. A tolerance written as plus 0.05 and minus 0.10 has a 0.15 mm band that is not centred on the nominal.

Resolution: The smallest change an instrument can display. A four-decimal readout has fine resolution and may still be inaccurate if the instrument is out of calibration.

Accuracy: How close a reading is to the true value, established by calibration against a traceable standard. Independent of resolution, and the property that decides whether a part passes.

Interlock: A condition wired or programmed to inhibit an action until it is satisfied, such as a guard-door switch that prevents a motor start while the door is open.

Closed-loop control: A control arrangement where a sensor measures the process, a controller compares that measurement to a setpoint, and an actuator drives the process until the difference closes.

Duty cycle: The proportion of a stated period during which equipment may operate at a stated output, for example 40 percent of a ten-minute period, after which it must cool.

Schematic versus pictorial diagram: A schematic shows function and connection logic with no regard to physical layout; a pictorial or exploded view shows physical arrangement and assembly order but hides the logic.

Root cause: The condition whose removal stops a failure recurring, as opposed to the symptom, which is only what became visible.

Study this next

- Technical reasoning skill hub: <https://learn.novusstreamsolutions.com/aptitude/skills/technical-reasoning>
- HVAC and refrigeration suite: <https://learn.novusstreamsolutions.com/aptitude/tests/hvac-and-refrigeration>
- Instrumentation and control suite:
<https://learn.novusstreamsolutions.com/aptitude/tests/instrumentation-and-control>
- Engineering and technical design careers:
<https://learn.novusstreamsolutions.com/careers/families/engineering-and-technical-design>
- Encyclopedia search: troubleshooting: <https://learn.novusstreamsolutions.com/search?q=Troubleshooting>
- Technical reasoning lesson on Novus Learn:
<https://learn.novusstreamsolutions.com/aptitude/skills/technical-reasoning/lesson>

Where this material comes from

- Diagnostic and metrology examples written for Novus Learn from general maintenance practice: binary-search fault isolation, asymmetric dimensional tolerance, and the ten-to-one instrument selection convention.

- Terminology checked against the public Wikipedia articles 'Troubleshooting', 'Engineering tolerance', 'Accuracy and precision' and 'Control loop'. Definitions only; every scenario above is original.
- Novus Learn aptitude construct registry (catalog seed) for the construct scope and related suite mapping.
- Public educational framing only: not affiliated with any official exam board, publisher or employer. Ratings and limits described here are illustrative and never override the equipment documentation in front of you.

Educational preparation only. Novus Learn does not administer official exams and does not guarantee scores or hiring outcomes.

Situational judgment

Evaluating workplace responses against role-relevant principles.

Learn a repeatable way to compare workplace responses: establish the facts, identify duties and risks, respect role boundaries, then choose a proportionate first action. This is educational preparation, not an official scoring guide.

What you should be able to do after this lesson:

1. Separate facts stated in a scenario from assumptions that the scenario does not support.
2. Rank response options by immediate risk, policy or role obligations, proportionality, and follow-through.
3. Explain why a strong first action is better than passive, punitive, or unauthorized alternatives.

Worked examples and pitfalls

Worked scenario: an unverified safety concern: A colleague reports a possible equipment fault while a deadline is approaching. First distinguish the known fact, the report, from the unverified cause. A strong response protects people and affected work, checks the concern through the right channel, tells the relevant lead, and records what was done. Ignoring the report underreacts; shutting down unrelated work or accusing someone before checking the facts overreacts.

Method: facts, duties, risks, response: Write four short notes before ranking options: what is known, who may be affected, which duty or boundary applies, and what safe next step is available now. Prefer an action that addresses the immediate issue and creates useful follow-through. Do not reward an option merely because it sounds decisive.

How to practise this skill

- Answer the question asked: best first action, worst action, or complete response are different tasks.
- Check whether an option acts within the person's authority and escalates only as far as the risk requires.
- When two options look reasonable, prefer the one that gathers missing facts and communicates ownership.

Glossary

Proportionality: Matching the urgency and scope of a response to the evidence, likely impact, and authority available.

Role boundary: The limit of what a person may decide or do without approval, specialist help, or escalation.

Follow-through: Confirming ownership, recording the decision, and checking that the issue was actually resolved.

Study this next

- Situational judgement test:
<https://learn.novusstreamsolutions.com/search?q=Situational%20judgement%20test>
- Workplace ethics: <https://learn.novusstreamsolutions.com/search?q=Workplace%20ethics>
- Decision-making: <https://learn.novusstreamsolutions.com/search?q=Decision-making>
- Situational judgment lesson on Novus Learn:
<https://learn.novusstreamsolutions.com/aptitude/skills/situational-judgement/lesson>

Where this material comes from

- Novus Learn original situational-judgment suite scenarios and published construct mapping.
- Novus educational framework: facts, duties, risks, role boundaries, proportional action, and follow-through.

Educational preparation only. Novus Learn does not administer official exams and does not guarantee scores or hiring outcomes.

Numerical reasoning

Arithmetic, fractions, percentages, ratios, rates, estimation, word problems, and number relationships.

Numerical reasoning is the ability to take a small set of supplied numbers (a price list, a staffing table, a fuel figure), and reach a defensible answer in around ninety seconds without a formula sheet. It is the most widely used quantitative section in graduate, management and public-sector screening, and it appears in banking, retail, armed forces and healthcare entry batteries alike. The arithmetic itself is deliberately ordinary: percentages, ratios, rates and averages. What is actually being measured is whether you pick the right operation quickly, keep the units straight, and answer the question that was asked rather than the one you started computing. Practice here is device-local: no account, and nothing leaves this device unless you export it.

What you should be able to do after this lesson:

1. Move between fractions, decimals, percentages and ratios on sight, and pick whichever form makes a given item fastest (12.5 percent as one eighth, 33.3 percent as one third).
2. Apply percentage change in both directions, including recovering an original figure from a post-increase total, and combine successive changes multiplicatively rather than by adding them.
3. Split a total in a stated ratio by counting parts first, and work backwards from a stated difference between two shares.
4. Solve rate problems (speed, unit price, consumption, combined work rates) by carrying units through every intermediate line so the units of the answer prove the method.
5. Produce a one-significant-figure estimate before computing, and use it to eliminate the distractors built from the common wrong operations.
6. Read a multi-step stem and name, in one sentence, the single quantity the final question asks for before touching the numbers.

Worked examples and pitfalls

Reverse percentages: the item most candidates get backwards: A subscription price rose by 15 percent and now stands at 57.50 pounds. What was it before? The correct move is to divide, not subtract: the new price is 115 percent of the old, so the old price is $57.50 / 1.15 = 50.00$. Check it forwards: 15 percent of 50 is 7.50, and $50 + 7.50 = 57.50$. The tempting wrong answer takes 15 percent of the NEW figure, $0.15 \times 57.50 = 8.625$, and reports 48.88. That distractor is always on the option list because it is what most people do under time pressure, and it is wrong by 2.25 percent, small enough to look plausible. The same asymmetry drives

the successive-change item: a price that rises 20 percent and then falls 20 percent does not return to where it started. Multiply the factors: $1.20 \times 0.80 = 0.96$, a net fall of 4 percent. Starting at 500 pounds you get 600 then 480, not 500. Percentages compose by multiplication; they never add.

Ratio splits: count the parts before you divide: A 4,830 pound budget is split between three teams in the ratio 3:5:6. Add the parts first: $3 + 5 + 6 = 14$. One part is $4,830 / 14 = 345$. The shares are $3 \times 345 = 1,035$, $5 \times 345 = 1,725$ and $6 \times 345 = 2,070$, and they sum back to 4,830, which is the check you should always run. Two classic failures. The first is dividing by 3 because there are three teams. That gives 1,610 each and ignores the ratio entirely. The second is treating 5 as a fraction and computing five sixths or five fourteenths of something other than the total. The more interesting version of this item gives you a difference instead of the total: 'the second team receives 690 pounds more than the first, what is the whole budget?' The difference between the shares is $5 - 3 = 2$ parts, so one part is $690 / 2 = 345$, and the budget is $14 \times 345 = 4,830$. Same number, reached from the other end, and the arithmetic is trivial once you have made the parts explicit.

Rates and units: 2 h 15 min is 2.25, not 2.15: A delivery van covers 174 km in 2 hours 15 minutes. Average speed is distance over time, and the time must be in hours: 15 minutes is $15/60 = 0.25$ h, so $174 / 2.25 = 77.3$ km/h. Type 2.15 into the calculator instead and you get 80.9 km/h: an error of roughly 4.7 percent that sits comfortably inside the plausible range and will match one of the options. Now extend it. The van consumes 8.6 litres per 100 km, so the trip needs $174 \times 8.6 / 100 = 14.964$ litres, and at 1.48 pounds per litre that is $14.964 \times 1.48 = 22.15$ pounds. Notice the units doing the work: (km) $\times$ (L / 100 km) leaves litres; (L) $\times$ (pounds / L) leaves pounds. If your intermediate line has km still attached at the end, you have divided when you should have multiplied. Write the unit next to every number and the method checks itself.

Unit pricing: normalise before you compare: Three pack sizes of the same fluid. Pack A: 750 ml for 3.60 pounds. Pack B: 2 litres for 9.40. Pack C: 1.5 litres for 7.20. Convert all three to price per litre. A: $3.60 / 0.75 = 4.80$ per litre. B: $9.40 / 2 = 4.70$. C: $7.20 / 1.5 = 4.80$. So B is cheapest by 10p a litre, and A and C are identical despite looking like different deals. The 'bigger pack is cheaper' heuristic happens to hold here but is not a rule, and test writers know it. Half of these items are built specifically so the largest pack loses. Now add the multibuy that these questions love: pack A is on three-for-two. Three packs give 2.25 litres for the price of two, 7.20 pounds, which is $7.20 / 2.25 = 3.20$ per litre and beats everything. The trap in the multibuy version is dividing by the number of packs paid for rather than the volume received.

Combined work rates: add rates, never times: Printer A completes a 3,000-page run in 50 minutes; printer B completes the same run in 75 minutes. Running together, how long? Convert to rates: A prints $3,000 / 50 = 60$ pages per minute, B prints $3,000 / 75 = 40$ pages per minute, and together they print 100 pages per minute, so the job takes $3,000 / 100 = 30$ minutes. Verify by counting output: in 30 minutes A produces 1,800 pages and B produces 1,200, which is 3,000 exactly. The two wrong answers you will see on the option list are 62.5 minutes (the average of 50 and 75) and 125 minutes (the sum). Both are impossible on inspection: two machines working together must finish faster than the faster machine alone, so any answer above 50 minutes is wrong before you compute anything. The general form is $1 / (1/50 + 1/75)$, and it is worth being able to write that line directly, but the sanity bound catches the error faster than the algebra does.

Estimate first, then compute: killing distractors in ten seconds: 'A department spent 847,300 pounds in 2024. In 2025 the budget fell by 12.5 percent. What was the 2025 spend?' Options: 741,387.50 / 953,212.50 / 105,912.50 / 762,570. Estimate before anything else: 12.5 percent is exactly one eighth, one eighth of roughly 850,000 is roughly 106,000, so the answer is roughly 744,000. That single line eliminates three options. 953,212.50 applied the change upwards. 105,912.50 is the size of the reduction, not the resulting spend: the 'answered the wrong question' distractor, and the most commonly selected wrong option on items of this shape. 762,570 is a 10 percent cut, planted for anyone who misread the rate. Exact working: $847,300 \times 7/8 = 5,931,100 / 8 = 741,387.50$. Doing it as a fraction avoids the decimal multiplication altogether. Learn the fraction equivalents cold (12.5 percent is $1/8$, 16.7 percent is $1/6$, 37.5 percent is $3/8$, 62.5 percent is $5/8$) because a fraction turns most percentage items into one division.

How to practise this skill

- Memorise the fraction-to-percentage table up to eighths and twelfths. Almost every 'nasty' percentage on these tests is a clean fraction in disguise, and the fraction route is two or three times faster than decimal multiplication.
- Write the unit beside every intermediate number, including the ones you keep in your head. Most numerical errors on timed sections are unit errors, not arithmetic errors, and units are the only cheap way to catch them.
- Rehearse reverse percentages as their own drill until dividing by 1.15 feels more natural than subtracting 15 percent. It is a single, identifiable technique that accounts for a disproportionate share of lost marks.
- Before selecting, re-read the last clause of the stem out loud. 'By how much did it fall' and 'what was it after the fall' have different answers, and both are always on the option list.
- Keep an error log with four columns (misread the question, wrong operation, unit slip, arithmetic slip), and tally which one you actually commit. Three sessions is usually enough to show that one column dominates, and that is the column to train.
- Work untimed until your method is stable, then add the clock in stages: generous, then realistic, then 20 percent tighter than the real test. Attempts stay on this device, so a slow first pass costs nothing.

Glossary

Percentage point: The arithmetic difference between two percentages. A rate moving from 4 percent to 5 percent rises by one percentage point but by 25 percent in relative terms; questions specify which they want and the two answers are both on the option list.

Reverse percentage: Recovering an original amount from a figure that already includes a percentage change, by dividing by the multiplier (1.15 for a 15 percent rise, 0.88 for a 12 percent fall) rather than subtracting the percentage from the new figure.

Multiplier (decimal factor): The single number a quantity is multiplied by to apply a percentage change: 1.20 for plus 20 percent, 0.80 for minus 20 percent. Successive changes are handled by multiplying the factors, which is why plus 20 then minus 20 gives 0.96, not 1.

Ratio part: One unit of a ratio split. Dividing the total by the sum of the ratio terms gives the value of one part; every share and every difference between shares is then a whole number of parts.

Unit rate: A quantity expressed per one of something: price per litre, pages per minute, litres per 100 km. Comparisons are only valid once every option has been converted to the same unit rate.

Combined rate: The sum of two or more individual rates working simultaneously. Times cannot be added or averaged; only rates add, and the combined time is the total work divided by the combined rate.

Significant figure estimate: Rounding every input to one meaningful digit to get an approximate answer in a few seconds. Its purpose is not accuracy but elimination: it removes any option that is off by a factor or has the sign of the change wrong.

Distractor: A wrong option written deliberately to match a specific predictable error: subtracting instead of dividing, reporting the change instead of the result, averaging instead of combining rates. Recognising the pattern is often faster than recomputing.

Study this next

- Numerical reasoning skill hub: <https://learn.novusstreamsolutions.com/aptitude/skills/numerical-reasoning>
- Numerical reasoning practice in the Cognitive Skills Lab: <https://learn.novusstreamsolutions.com/cognitive-skills/numerical-reasoning>
- Data interpretation lesson: <https://learn.novusstreamsolutions.com/aptitude/skills/data-interpretation/lesson>
- Office numeracy suite: <https://learn.novusstreamsolutions.com/aptitude/tests/office-numeracy>

- Finance, accounting and insurance careers:
<https://learn.novusstreamsolutions.com/careers/families/finance-accounting-and-insurance>
- Numerical reasoning lesson on Novus Learn:
<https://learn.novusstreamsolutions.com/aptitude/skills/numerical-reasoning/lesson>

Where this material comes from

- All worked figures above were written and checked for Novus Learn. Every division, ratio split and rate calculation in this lesson was verified by recomputing it in the reverse direction.
- Conventions only (percentage point, unit rate, significant figures) cross-checked against standard public references such as the Wikipedia articles 'Percentage', 'Ratio' and 'Rate (mathematics)'. No item text is drawn from any published test.
- Novus Learn aptitude construct registry (catalog seed) for construct scope and suite mapping.
- Public educational framing only: not affiliated with any official exam board, publisher or employer, and no copyrighted test item is reproduced.

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Safety judgment

Hazard recognition, safe sequencing, escalation, and risk controls.

Practise recognizing hazards and choosing a safe, proportionate response: protect people, control immediate exposure, use the correct reporting path, and verify that the control is effective.

What you should be able to do after this lesson:

1. Separate a hazard from the likelihood, severity, and exposure that shape its risk.
2. Choose an immediate control that stays within the person's training and authority.
3. Recognize when work should pause and when a supervisor, emergency process, or qualified specialist is needed.

Worked examples and pitfalls

Worked scenario: a damaged machine guard: A guard is loose before a scheduled run. Do not operate the machine or improvise a repair beyond your authorization. Keep people away, isolate or label the equipment only as procedure permits, report the defect to the responsible person, and wait for an approved inspection or repair. A deadline does not remove the hazard.

Risk-triage questions: Ask: what can cause harm, who is exposed now, how severe could the outcome be, what control is available, and who has authority to apply it? The safest answer is not always the most dramatic option; it is the option that controls the real exposure without creating a new hazard.

How to practise this skill

- Treat warnings, permits, isolation rules, and personal protective equipment as parts of a system, not interchangeable shortcuts.
- Do not ask an untrained person to investigate a hazard simply because they are nearby.
- In real work, site procedures and qualified safety direction override any general preparation heuristic.

Glossary

Hazard: A source or situation with the potential to cause harm.

Risk: A judgement about possible harm that considers likelihood, severity, and exposure.

Control: A measure that removes a hazard or reduces exposure to it under an approved process.

Study this next

- Occupational safety and health:
<https://learn.novusstreamsolutions.com/search?q=Occupational%20safety%20and%20health>
- Hazard: <https://learn.novusstreamsolutions.com/search?q=Hazard>
- Risk assessment: <https://learn.novusstreamsolutions.com/search?q=Risk%20assessment>
- Safety judgment lesson on Novus Learn:
<https://learn.novusstreamsolutions.com/aptitude/skills/safety-judgement/lesson>

Where this material comes from

- Novus Learn original safety-critical, hazard-recognition, and operational suite scenarios.
- Novus educational framework: identify the hazard, protect people, control exposure, report, and verify.

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Error detection

Comparing strings, records, transactions, forms, and data for mistakes.

Error detection is the skill of holding a source and a copy side by side and finding the one character, digit or field that moved, and of knowing which errors a given check will and will not catch. It is assessed directly in clerical checking, banking operations, records, proofreading and dispatch selection, and it underpins quality control anywhere a record is rekeyed or transcribed. The useful part of the skill is not staring harder; it is a repeatable scan procedure plus a set of arithmetic checks that catch what the eye misses. Everything you practise is stored on this device only, with no account and no upload unless you export it.

What you should be able to do after this lesson:

1. Name the four transcription error families (substitution, transposition, omission, duplication), and state which of them a plain digit-sum check will fail to detect.
2. Run a fixed field-order comparison between a source record and a copy, reporting the specific field and character position that differs rather than a general impression.
3. Compute a modulus 11 check digit (ISBN-10 style) by hand and use it to decide whether a single record is internally consistent.
4. Apply the Luhn algorithm to a candidate account number, and state the one transposition case Luhn provably cannot catch.
5. Work out, from a stated scoring rule, whether guessing on an uncertain item has positive, zero or negative expected value.
6. Reconcile a document at batch level (line totals, subtotal, tax, grand total) and explain why an internally consistent document can still be wrong.

Worked examples and pitfalls

The four transcription error families: Source reference: INV-2024-08871. Four corrupted copies, one of each family. INV-2024-08571 is a substitution: a single character changed, 8 to 5. INV-2024-0871 is an omission: one character dropped, and the string is now a character short. INV-2024-088711 is a duplication: a

character repeated, one character long. INV-2024-08817 is a transposition: the final 7 and 1 have swapped places, and crucially the string is the same length and contains exactly the same characters. That last property is why transposition is the hardest of the four to see and the most dangerous in practice. Anything that checks length catches omission and duplication. Anything that compares character sets or sums the digits catches substitution but not transposition, because $0+8+8+7+1$ and $0+8+8+1+7$ both come to 24. Reading the reference aloud catches substitution reliably and transposition poorly, because the ear is comparing sounds and both versions sound similar at speed. The only defences against transposition are a positional comparison and a weighted check digit.

A fixed scan order finds the one field that moved: Source record: Name Priyanka Ramaswamy / Account 4471-9026-3358 / Date of birth 14/03/1991 / Postcode SW1A 2AA / Phone 0161 496 0872. Copy: Name Priyanka Ramaswamy / Account 4471-9026-3358 / Date of birth 14/03/1991 / Postcode SW1A 2AA / Phone 0161 469 0872. The difference is in the phone field, where 496 has become 469: a transposition inside the middle block. Most candidates find it eventually; the ones who find it in eight seconds are the ones running a procedure. Always compare in the same field order, top to bottom, never skipping a field because it 'looks fine'. Compare long strings in the printed blocks rather than as a single run (4471, then 9026, then 3358) because short-term memory holds about four items and a twelve-digit run does not fit. Say the block silently, look, compare, move on. On a same-or-different item you may stop at the first mismatch; on a 'how many fields differ' item you must complete every field, and the instruction wording is what tells you which regime you are in. Getting this wrong in either direction costs marks: stopping early on a count item, or exhaustively checking a same-or-different item you had already resolved.

Modulus 11: why a weighted check digit catches a transposition: The ISBN-10 scheme multiplies the ten digits by descending weights 10, 9, 8 down to 1 and requires the total to be divisible by 11. Take 0-306-40615-2. Working left to right: $10 \times 0 = 0$, $9 \times 3 = 27$, $8 \times 0 = 0$, $7 \times 6 = 42$, $6 \times 4 = 24$, $5 \times 0 = 0$, $4 \times 6 = 24$, $3 \times 1 = 3$, $2 \times 5 = 10$, and the check digit $1 \times 2 = 2$. The sum is $0 + 27 + 0 + 42 + 24 + 0 + 24 + 3 + 10 + 2 = 132$, and $132 = 12 \times 11$ exactly, so the number is valid. Now transpose the 1 and the 5 to give 0-306-40651-2. The digits are identical, so a plain digit sum is unchanged at 27 either way and would report no problem. The weighted sum, however, becomes $0 + 27 + 0 + 42 + 24 + 0 + 24 + 15 + 2 + 2 = 136$, and $136 - 132 = 4$, so it is not a multiple of 11 and the record is rejected. That is the entire reason check digits are weighted rather than plain: position has to matter, or the commonest human error passes straight through.

Luhn: the number that fails, and the one case it misses: The Luhn check, used on payment and many membership numbers, doubles every second digit counting from the right, subtracts 9 from any doubled result above 9, sums everything, and requires a total ending in zero. Take 4539 1488 0343 6467. The doubled positions contribute 3, 3, 8, 0, 7, 2, 6 and 8, totalling 37; the undoubled positions contribute 7, 4, 3, 3, 8, 4, 9 and 5, totalling 43. The grand total is 80, which ends in zero, so the number passes. Now transpose the last two digits to 4539 1488 0343 6476. The doubled contributions become 5, 3, 8, 0, 7, 2, 6, $8 = 39$ and the undoubled become 6, 4, 3, 3, 8, 4, 9, $5 = 42$, giving 81. Not a multiple of ten, so the mistyped number is rejected at the point of entry. Luhn catches every single-digit substitution and almost every adjacent transposition: with exactly one blind spot. Swapping an adjacent 0 and 9 leaves the total unchanged, because doubling 0 gives 0 and doubling 9 gives 18 which reduces to 9, so both digits contribute the same amount whether doubled or not. A form that validates with Luhn will happily accept 90 where you typed 09. Knowing the blind spot is the point: a check digit narrows the space of undetected errors, it never closes it.

Negative marking: 44 right can beat 46 right: Many clerical checking sections score correct minus incorrect, with omissions neutral. Under that rule, guessing between two remaining options has an expected value of $0.5 \times (+1) + 0.5 \times (-1) = 0$, exactly neutral, and guessing blindly among four options has an expected value of $0.25 - 0.75 = -0.5$, clearly negative. Concretely: on a 60-item section you attempt 48, get 44 right and 4 wrong, and score 40. A colleague attempts all 60, gets 46 right and 14 wrong, and scores 32. More correct answers, a lower score. Reverse the scoring rule to plain raw-correct with no penalty and the ordering flips: 46 beats 44 and leaving a blank becomes strictly irrational. Neither strategy is universally right, which is why

the instruction screen is not optional reading. Find the sentence that says whether wrong answers are penalised, and if it is absent, assume raw scoring and answer everything.

Reconcile the batch: consistent is not the same as correct: An invoice lists three lines: 12 at $14.25 = 171.00$; 7 at $33.60 = 235.20$; 3 at $128.00 = 384.00$. The stated subtotal is 709.20, VAT at 20 percent is stated as 141.84, and the total is stated as 851.04. Every downstream figure checks out against the one above it: $709.20 \times 0.20 = 141.84$ and $709.20 + 141.84 = 851.04$. Nothing in the tax or total column is inconsistent. But recompute the lines: $171.00 + 235.20 + 384.00 = 790.20$, not 709.20. The subtotal is a transposition of the correct figure, and because every later number was calculated from the wrong subtotal, the document is perfectly self-consistent and perfectly wrong. The true VAT should be 158.04 and the true total 948.24, a shortfall of 97.20. This is the single most valuable habit in the construct: never verify a total against the number printed above it, always recompute it from the underlying items. Internal consistency proves that one person did the arithmetic carefully; it proves nothing about whether they started from the right number.

How to practise this skill

- Drill transposition specifically. Generate pairs where the only difference is two adjacent characters swapped, because that is the family your eye is worst at and the family a naive check will not catch.
- Fix a scan order and never vary it: field by field, top to bottom, and within a long value block by block. Free-roaming comparison feels faster and reliably misses one field per record.
- Learn one check-digit scheme by hand, modulus 11 is the easiest, until you can run it in about twenty seconds. It converts a whole class of 'does this record look right' items from judgement into arithmetic.
- Read the scoring rule before the first item and decide your guessing policy then, not at minute seven when you are behind. Under penalty scoring, an omission is a legitimate answer; under raw scoring it is a wasted mark.
- When you are checking financial or tabular documents, recompute the lowest-level figures first and work upward. Errors introduced at a subtotal propagate perfectly and are invisible from below.
- Log the errors you miss, not the ones you find. A miss log after four sessions usually shows a personal signature (always the middle of long numeric strings, or always the second occurrence of a repeated field), and that signature is what to drill.

Glossary

Transposition error: Two adjacent characters exchanged, as in 496 typed for 469. Length and character content are unchanged, so length checks and plain digit sums both pass it; only positional comparison or a weighted check digit detects it.

Substitution error: One character replaced by another, as in 08571 for 08871. It is the family most reliably caught by reading a value aloud against the source, and by any check digit scheme.

Check digit: An extra digit computed from the others so that a corrupted record fails an arithmetic test. It detects errors; it never corrects them and never proves the record refers to the right person or item.

Modulus 11: A weighted check scheme in which digits are multiplied by descending position weights and the total must divide by 11. Used in ISBN-10 and several banking and national identifier formats.

Luhn algorithm: A modulus 10 check that doubles alternate digits from the right and requires the sum to end in zero. It catches all single-digit errors and most adjacent transpositions except an adjacent 0 and 9.

Miss and false alarm: A miss is a genuine discrepancy passed as correct; a false alarm is a difference flagged where none exists, usually a formatting variant such as a trailing space or a differently written date. Misses are the costlier of the two in records work, which is why procedures normalise formatting first and then bias toward escalating doubt.

Correction for guessing: A scoring rule that subtracts a fraction or multiple of the wrong answers from the correct ones, making blind guessing negative in expectation and turning omission into a rational choice.

Reconciliation: Recomputing an aggregate from its components rather than accepting the printed figure. It is the only check that catches an error introduced at summary level, where everything below and above it still agrees.

Study this next

- Error detection skill hub: <https://learn.novusstreamsolutions.com/aptitude/skills/error-detection>
- Error detection practice in the Cognitive Skills Lab:
<https://learn.novusstreamsolutions.com/cognitive-skills/error-detection>
- Data checking and clerical accuracy lesson:
<https://learn.novusstreamsolutions.com/aptitude/skills/clerical-accuracy/lesson>
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- Error detection lesson on Novus Learn:
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Where this material comes from

- The ISBN-10 modulus 11 worked example (0-306-40615-2, weighted sum 132) and the Luhn worked example (4539 1488 0343 6467, sum 80) were computed by hand for this lesson and each was re-verified digit by digit, including the corrupted variants.
- Algorithm definitions cross-checked against the public specifications described in the Wikipedia articles 'International Standard Book Number' and 'Luhn algorithm', including the documented 09/90 transposition blind spot. Records, invoices and reference numbers above are invented.
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